IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT APPLICATION

Applicants : Robert E. Beach et al.

Application No.: 09/627,092

Filed : July 27, 2000

For : VOICE AND DATA WIRELESS COMMUNICATIONS NETWORK AND METHOD

Hon. Commissioner for Patents
P.O. Box 2327
Arlington V.A. 22202

PRELIMINARY AMENDMENT

Sir:

Preliminary to the examination, applicants hereby amend the above-identified application as follows:

In the Specification

Please replace the paragraph at page 2, line 7 through line 22, with the following amended version of that paragraph:

The standard further specifies that packet size may vary. A remote terminal that has a relatively large packet to transmit may need to occupy the shared communications medium for a longer period than a remote terminal that has a relatively short packet to transmit. Until recently, delays in communicating packets have typically been non-critical to providing communications at least

partly because of the type of information that has been transmitted in such systems. Information such as bar code information, package tracking information, etc. typically remains valid until a next incremental event occurs (e.g., until bar code information has changed, until a package is tracked to a next point in route, etc.). In addition, such information does not generally affect system communications if delivered with some delay.

Please replace the paragraph at page 4, line 32 through page 5, line 25, with the following amended version of that paragraph:

For each transmitted packet, an acknowledgment (e.g., an acknowledge packet) from a receiving terminal may be required before the transmitter discards the transmitted packet or moves onto transmitting the next packet for that terminal. A transmitter may repeatedly transmit a packet until it is acknowledged or until a retry threshold (e.g., a total number of times that a packet is to be transmitted) has been reached. The retry threshold may be determined based on whether the packet that is being retransmitted is for voice communications. The retry threshold for voice communications may be lower than for other communications. In communications networks that use frequency hopping spread spectrum communications, a packet may be retransmitted when the number of times the packet has been transmitted reaches an initial retry threshold. When the initial retry threshold is reached without an acknowledgment being received, retransmission may be discontinued

until after a frequency hop in modulation. Thereafter, retransmissions may resume until an acknowledgment is received or until a total retry threshold has been reached. The initial and total retry thresholds may vary based on whether the packet that is being retransmitted is for voice communications.

Please replace the paragraph at page 10, line 32 through page 11, line 8, with the following amended version of that paragraph:

A network-operating-system may be implemented on each terminal 26. In each terminal 26, the interface card may be coupled to the network-operating-system application using the software driver. The interface card for each remote terminal 26 may be a network-communications interface. The network interface card for each terminal 26 is typically implemented to use a carrier sense access protocol and to modulate communications signals with a spreading sequence.

Please replace the paragraph at page 13, line 4 through line 8, with the following amended version of that paragraph:

The wireline network that is coupled to access point 24 may include equipment that is configured to implement the wireline network. The wireline network may be coupled to an external network (e.g., PBX, PSTN, Internet, etc.).

Please replace the paragraph at page 15, line 26 through page 16, line 6, with the following amended version of that paragraph:

An access point may select and transmit packets for each terminal in each round in the order in which the packets for that terminal were received by the access point. With continued reference to FIG. 3b, in the first round, the access point transmits packets nos. 2, 3, 6 and 1 that are each the first packet in queues 58, 60, 62, and 64, respectively. In the second round, the access point transmits packets nos. 4, 8, 7 and 5 that are each the next packet that was received for each terminal T1, T2, T3 and T4, respectively. In each round, one packet from each queue is transmitted without having competition between the queues for a position in the round.

Please replace the paragraph at page 16, line 31 through page 17, line 17, with the following amended version of that paragraph:

Illustrative queues 72, 74 and 76 of FIG. 4b may be provided based on the illustrative steps of FIG. 4a. Queue 72 may include packets that have been received by an access point for transmission to terminals T1 and T2. Queue 72 includes packets that are to be transmitted to provide voice communications (packets nos. 1, 4 and 6). Packets that are for voice communications are prioritized higher than other packets in queues 74 and 76 so that these voice packets are transmitted before other packets. Queue 74

for terminal T1 includes voice packet no. 6 that is prioritized higher than packets nos. 3 and 5 which were received before packet no. 6. Queue 76 for terminal T2 includes voice packets nos. 1 and 4 that are prioritized higher than packets nos. 2 and 7 that are for other communications. Within each queue, voice packets are prioritized to be transmitted before other packets. All packets in a queue are further prioritized for transmission based on when each packet was received by the access point.

Please replace the paragraph at page 26, line 20 through page 27, line 3, with the following amended version of that paragraph:

Illustrative packet transmission rounds 148, 150, 152 and 162 of FIG. 10b may be implemented based on the illustrative steps of FIG. 10a. In round 148 (the first round), packet A is transmitted by access point 154 to terminal T2 and an acknowledgment is not transmitted in reply by terminal T2. In round 150 (the second round), packet A is retransmitted and an acknowledgment is again not received from terminal T2. Packet A continues to be transmitted in the subsequent rounds for a total of n rounds where in each round an acknowledgment for packet A is not received. The value of n may be a retry threshold and the valve may be different for voice and data packets. After the nth round 152, retransmissions of packet A may be discontinued and a different packet (e.g., the next highest priority packet for terminal T2) may be transmitted in the subsequent round, round 162.

Please replace the paragraph at page 27, line 31 through page 28, line 13, with the following amended version of that paragraph:

Illustrative transmission rounds 176, 178, 180 and 182 of FIG. 11b may be implemented based on the illustrative steps of FIG. 11a. In round 176, access point 184 may transmit packet A to terminal T2. In round 178, access point 184 may again transmit packet A to terminal T2 when an acknowledgment packet was not received for packet A in the previous round. In the following rounds, access point 184 continues to retransmit packet A while a responsive acknowledgment has not been received and until packet A has been transmitted a particular number of times k. When packet A has been transmitted k times, any further retransmissions are halted until a hop in the frequency that is being used for spread spectrum communications. In round 182 after a frequency hop, access point 184 resumes transmitting packets to terminal T2.

Please replace the paragraph at page 29, line 1 through page 30, line 2, with the following amended version of that paragraph:

Illustrative queues 206, 208, 210, 212 and 214 of FIG. 12b may be implemented based on the illustrative steps of FIG. 12a. Queues 206 and 208 may be queues that include prioritized packets that access point 216 is to transmit to terminals T1 and T2, respectively. In a first round, when a half-duplex communications channel (e.g., a predetermined frequency band on which multiple

devices communicate using CSMA and spread spectrum modulation) is determined to be idle, the access point may transmit packets nos. 1 and 6 which are the highest priority packets for T1 and T2, respectively. In the first round, packet no. 6 (UDP) that is transmitted to a voice-capable terminal T2 is unacknowledged by terminal T2. For the next round, packet no. 6 is reinserted into queue 208 for terminal T2. Additional packets 210 may be received by the access point 216 for transmission to terminals T1 and T2 before the next round of packets are to be transmitted. Queues 206a and 206b may be implemented when the additional packets are prioritized. Queues 206a and 206b include prioritized packets that are to be transmitted to terminals T1 and T2, respectively. In the previous round, packet no. 6 for terminal T2 was unacknowledged and reinserted into queue 208a. New management packet 13 for terminal T2 has been received after the first round and has been prioritized to have a higher priority than packet no. 6. When access point 216 transmits the highest priority packet for terminal T2, packet no. 13 is transmitted over unacknowledged packet no. 6. Thus, retransmission of packet no. 6 is preempted by transmission of higher priority packet no. 13. Retransmission may commence in a future round when packet no. 6 is the highest priority packet that is pending to be transmitted for terminal T2.

In the Claims

Please cancel claims 1-23, without prejudice.

Please amend the claims as follows:

24. (Amended) An access point that provides voice and data communications for use in a wireless local area network having a plurality of mobile units, at least one of said mobile units being voice-capable, said access point being configured to:

receive signals carrying communications packets directed to particular mobile units;

prioritize communications packets for transmission based on:

whether each packet is directed to a voice-capable mobile unit;

the total number of packets transmitted to each mobile unit; and

the order in which the packets were received by the access point.

25. (Amended) A method for providing voice and data communications for use in a wireless local area network having an access point and a plurality of mobile units, at least one of the mobile units being voice-capable, comprising:

receiving signals at the access point which carry communications packets directed to particular mobile units;

prioritizing received communications packets for transmission based on:

whether each packet is directed to a voice-capable mobile unit;

the total number of packets transmitted to each mobile unit; and

the order in which the packets were received by the access point.

REMARKS

The specification has been amended to address inadvertent typographical errors. Appendix A showing the changes to the specification is attached.

Claims 1-23 have been canceled without prejudice. Claims 24 and 25 have been amended to more particularly point out and define the claimed invention. Appendix B showing the changes to the claims is attached.

Applicants submit that this application is in condition for allowance. An early and favorable response is respectfully requested.

Respectfully submitted,

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APPENDIX A

Version Showing Changes Made to the Specification

Please amend the specification as follows:

At page 2, line 7 through line 22:

The standard further specifies that packet size may vary. A remote terminal that has a relatively large packet to transmit may need to occupy the shared communications medium for a longer period than a remote terminal that has a relatively short packet to transmit. Until recently, delays in communicating packets have typically been non-critical to providing communications at least partly because of the type of information that has been transmitted in such systems. Information such as bar code information, package tracking information, etc. typically remains valid until a next incremental event occurs (e.g., until bar code information has changed, until a package is tracked to a next point in route, etc.). In addition, such information does not generally [effect] affect system communications if delivered with some delay.

At page 4, line 32 through page 5, line 25:

For each transmitted packet, an acknowledgment (e.g., an acknowledge packet) from a receiving terminal may be required before the transmitter discards the transmitted packet or moves onto transmitting the next packet for that terminal. A transmitter may repeatedly transmit a packet until it is acknowledged or until a retry threshold (e.g., a total number of times that a packet is to

be transmitted) has been reached. The retry threshold may be determined based on whether the packet that is being retransmitted is for voice communications. The retry threshold for voice communications may be lower than for other communications. In communications networks that use frequency hopping spread spectrum communications, a packet may be retransmitted when the number of times the packet has been transmitted reaches an initial retry threshold. When the initial retry threshold is reached without an acknowledgment being received, retransmission may be discontinued until after a frequency hop in modulation. Thereafter, retransmissions may resume until an acknowledgment is received or until a total retry threshold has been reached. The initial and total retry thresholds may vary based on whether the packet that is being retransmitted is for voice communications. [New packets that are received and prioritized may have a higher priority than an unacknowledged packet.]

At page 10, line 32 through page 11, line 8:

A network-operating-system may be implemented on each terminal 26. In each terminal 26, the interface card may be coupled to the network-operating-system application using the software driver. The interface card for each remote terminal 26 may be a network-communications interface. The network interface card for each terminal 26 [are] <u>is</u> typically implemented to use a carrier sense access protocol and to modulate communications signals with a spreading sequence.

At page 13, line 4 through line 8:

The wireline network that is coupled to access point 24 may include equipment [23] that is configured to implement the wireline network. The wireline network may be coupled to an external network (e.g., PBX, PSTN, Internet, etc.).

At page 15, line 26 through page 16, line 6:

An access point may select and transmit packets for each terminal in each round in the order in which [that] the packets for that terminal were received by the access point. With continued reference to FIG. 3b, in the first round, the access point transmits packets nos. 2, 3, 6 and 1 that are each the first packet in queues 58, 60, 62, and 64, respectively. In the second round, the access point transmits packets nos. 4, 8, 7 and 5 that are each the next packet that was received for each terminal T1, T2, T3 and T4, respectively. In each round, one packet from each queue is transmitted without having competition between the queues for a position in the round.

At page 16, line 31 through page 17, line 17:

Illustrative queues 72, 74 and 76 of FIG. 4b may be provided based on the illustrative steps of FIG. 4a. Queue 72 may include packets that have been received by an access point for transmission to terminals T1 and T2. Queue 72 includes packets that are to be transmitted to provide voice communications (packets nos. 1, 4 and 6). Packets that are for voice communications are

prioritized higher than other packets in queues 74 and 76 so that these voice packets are transmitted before other packets. Queue 74 for terminal T1 includes voice packet no. 6 that is prioritized higher than packets nos. 3 and 5 which were received before packet no. 6. Queue 76 for terminal T2 includes voice packets nos. 1 and 4 that are prioritized higher than packets nos. 2 and 7 that are for other communications. Within each queue, voice packets are prioritized to be transmitted before other packets. All packets in a queue are further prioritized for transmission based on when each packet was received by the access point.

At page 26, line 20 through page 27, line 3:

Illustrative packet transmission rounds 148, 150, 152 and 162 of FIG. 10b may be implemented based on the illustrative steps of FIG. 10a. In round 148 (the first round), packet A is transmitted by access point 154 to terminal T2 and an acknowledgment is not transmitted in reply by terminal T2. In round 150 (the second round), packet A is retransmitted and an acknowledgment is again not received from terminal T2. Packet A continues to be transmitted in the subsequent rounds for a total of n rounds where in each round an acknowledgment for packet A [has] is not received. The value of n may be a retry threshold and the valve may be different for voice and data packets. After the nth round 152, retransmissions of packet A may be discontinued and a different packet (e.g., the next highest priority packet for terminal T2) may be transmitted in the subsequent round, round 162.

At page 27, line 31 through page 28, line 13:

Illustrative transmission rounds 176, 178, 180 and 182 of FIG. 11b may be implemented based on the illustrative steps of FIG. 11a. In round 176, access point 184 may transmit packet A to terminal T2. In round 178, access point 184 may again transmit packet A to terminal T2 when an acknowledgment packet was not received for packet A in the previous round. In the following rounds, access point 184 continues to retransmit packet A while a responsive acknowledgment has not been received and until packet A has been transmitted a particular number of times k. When packet A has been transmitted k times, any further retransmissions are halted until a hop in the frequency that is being used for spread spectrum communications. In round 182 after a frequency hop, access point [182] 184 resumes transmitting packets to terminal T2.

At page 29, line 1 through page 30, line 2:

Illustrative queues 206, 208, 210, 212 and 214 of FIG. 12b may be implemented based on the illustrative steps of FIG. 12a. [Queue] Queues 206 and 208 may be queues that include prioritized packets that access point 216 is to transmit to terminals T1 and T2, respectively. In a first round, when a half-duplex communications channel (e.g., a predetermined frequency band on which multiple devices communicate using CSMA and spread spectrum modulation) is determined to be idle, the access point may transmit packets nos. 1 and 6 which are the highest priority packets for T1 and T2, respectively. In the first round, packet no. 6 (UDP) that is

transmitted to a voice-capable terminal T2 is unacknowledged by terminal T2. For the next round, packet no. 6 is reinserted into queue 208 for terminal T2. Additional packets 210 may be received by the access point 216 for transmission to terminals T1 and T2 before the next round of packets are to be transmitted. Queues 206a and 206b may be implemented when the additional packets are prioritized. Queues 206a and 206b include prioritized packets that are to be transmitted to terminals T1 and T2, respectively. In the previous round, packet no. 6 for terminal T2 was unacknowledged and reinserted into queue 208a. New management packet 13 for terminal T2 has been received after the first round and has been prioritized to have a higher priority than packet no. 6. When access point 216 transmits the highest priority packet for terminal T2, packet no. 13 is transmitted over unacknowledged packet no. 6. Thus, retransmission of packet no. 6 is preempted by transmission of higher priority packet no. 13. Retransmission may commence in a future round when packet no. 6 is the highest priority packet that is pending to be transmitted for terminal T2.

APPENDIX B

Version Showing Changes Made to the Claims

24. (Amended) An access point that provides voice and data communications for use in a wireless local area network having a plurality of mobile units, at least one of said mobile units being voice-capable, said access point being configured to:

receive signals carrying communications packets directed to particular mobile units[, and];

prioritize communications packets for transmission based on:[at least partly on whether each packet is directed to a voice-capable mobile unit.]

whether each packet is directed to a voice-capable mobile unit;

the total number of packets transmitted to each mobile unit; and

the order in which the packets were received by the access point.

25. (Amended) A method for providing voice and data communications for use in a wireless local area network having an access point and a plurality of mobile units, at least one of the mobile units being voice-capable, comprising:

receiving signals at the access point which carry communications packets directed to particular mobile units; [and]

prioritizing received communications packets for transmission based on:[at least partly on whether each packet is directed to a voice-capable mobile unit.]

whether each packet is directed to a voice-capable mobile unit;

the total number of packets transmitted to each mobile unit; and

the order in which the packets were received by the access point.